MAGNETOLIPOSOMES AS NANOCARRIERS FOR FLUORESCENT POTENTIAL ANTITUMOR DRUGS

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Magneto-sensitive liposomes can be obtained by encapsulation of magnetic nanoparticles into liposomes or by the coverage of magnetic nanoparticles with a lipid bilayer. The so-called magnetoliposomes make possible to explore the synergistic effect between chemotherapy and magnetic hyperthermia. Recently, both aqueous magnetoliposomes (AMLs, containing magnetic nanoparticles entrapped in liposomes) and solid magnetoliposomes (SMLs, where clusters of nanoparticles are covered by a lipid bilayer) containing several different nanoparticles (magnetite, nickel ferrite, manganese ferrite or magnesium ferrite) have been developed,[1-4] exhibiting a superparamagnetic behavior and diameters below 150 nm (figure 1A).

These nanosystems were successfully tested as carriers for fluorescent potential antitumor drugs.[2-4] Fluorescence-based methodologies (FRET, emission quenching and fluorescence anisotropy) have been employed as valuable tools for this investigation. Drug-loaded magnetoliposomes have shown the ability to interact by fusion with GUVs (giant unilamellar vesicles, used as models of biomembranes)[1-3] (figure 1B) and to release the antitumor drugs in *in vitro* assays using human tumor cell lines,[4] being promising for the development of a dual therapy of cancer (combining chemotherapy and magnetic hyperthermia).

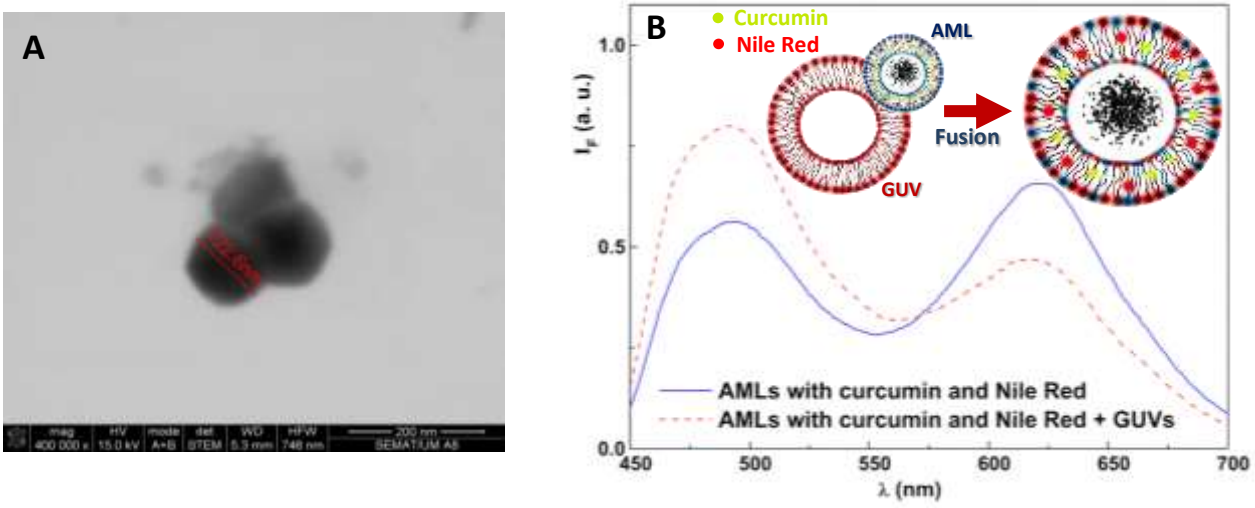

Figure 1. A: STEM image of solid magnetoliposomes (SMLs) based on Fe_3O_4 nanoparticles. **B:** Fluorescence spectra of aqueous magnetoliposomes (AMLs) containing both curcumin (as energy donor) and Nile Red (as energy acceptor), exciting only curcumin, before and after interaction with GUVs.

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References

[1] A. R. O. Rodrigues, I. T. Gomes *et al.*, *Phys. Chem. Chem. Phys.* **2015**, *17*, 18011-18021.
[2] A. R. O. Rodrigues, J. M. F. Ramos *et al.*, *RSC Advances* **2016**, *6*, 17302-17313.
[3] A. R. O. Rodrigues, P. M. F. Mendes *et al.*, *Colloid Surf. B-Biointerfaces* **2017**, *158,* 460-468.
[4] A. R. O. Rodrigues, B. G. Almeida *et al.*, *RSC Advances* **2017**, *7*, 15352-15361.